



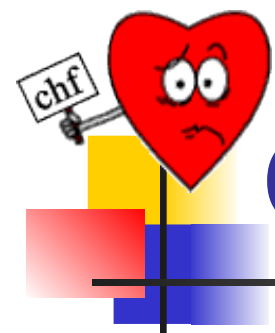
# Congestive Heart Failure

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Madi Capoccia DO

MAJ, USAF, MC

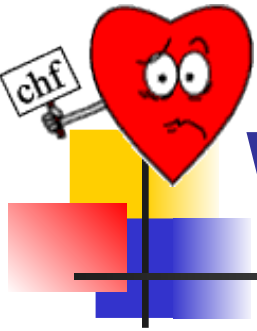
Malcolm Grow Medical Center



# Objectives

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- Definition and Epidemiology
- Pathophysiology
- Diagnosis and Classification
- Treatment of Systolic Dysfunction

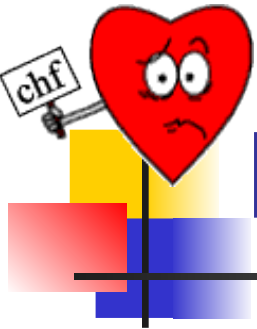


# What is CHF?

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## *Definition*

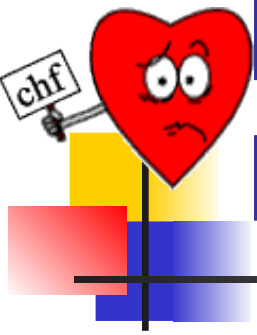
- Abnormality of cardiac function that leads to the inability of the heart to pump blood to meet the body's basic metabolic demands or when it can do so only with an elevated filling pressure



# Epidemiology

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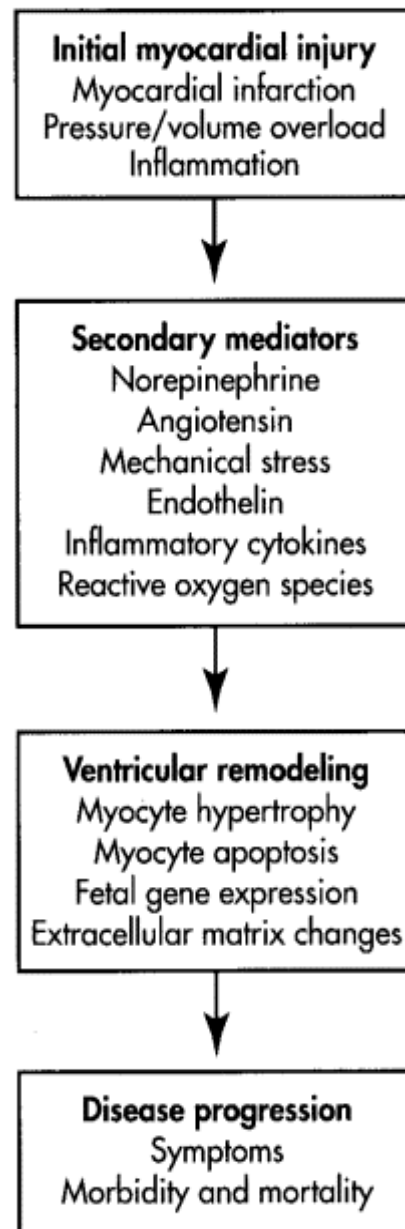
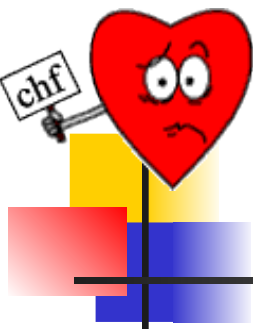
- **Prevalence**
  - Affects nearly 5 million Americans currently, 400,000 new cases diagnosed each year
- **Cost**
  - Annual direct cost in >\$10 billion dollars
- **Incidence increased with age**
  - Effects 1-2% of patient from 50-59-years-old and 10% of patient over the age of 75
- **Frequency**
  - It is the most common inpatient diagnosis in the US for patients over 65 years of age
  - Visits to their family practitioner on average 2-3 times per year
- **Gender**
  - Men > women in those between 40 and 75 years of age
  - The sexes are equal over 75 years of age



# Pathophysiology of Heart Failure

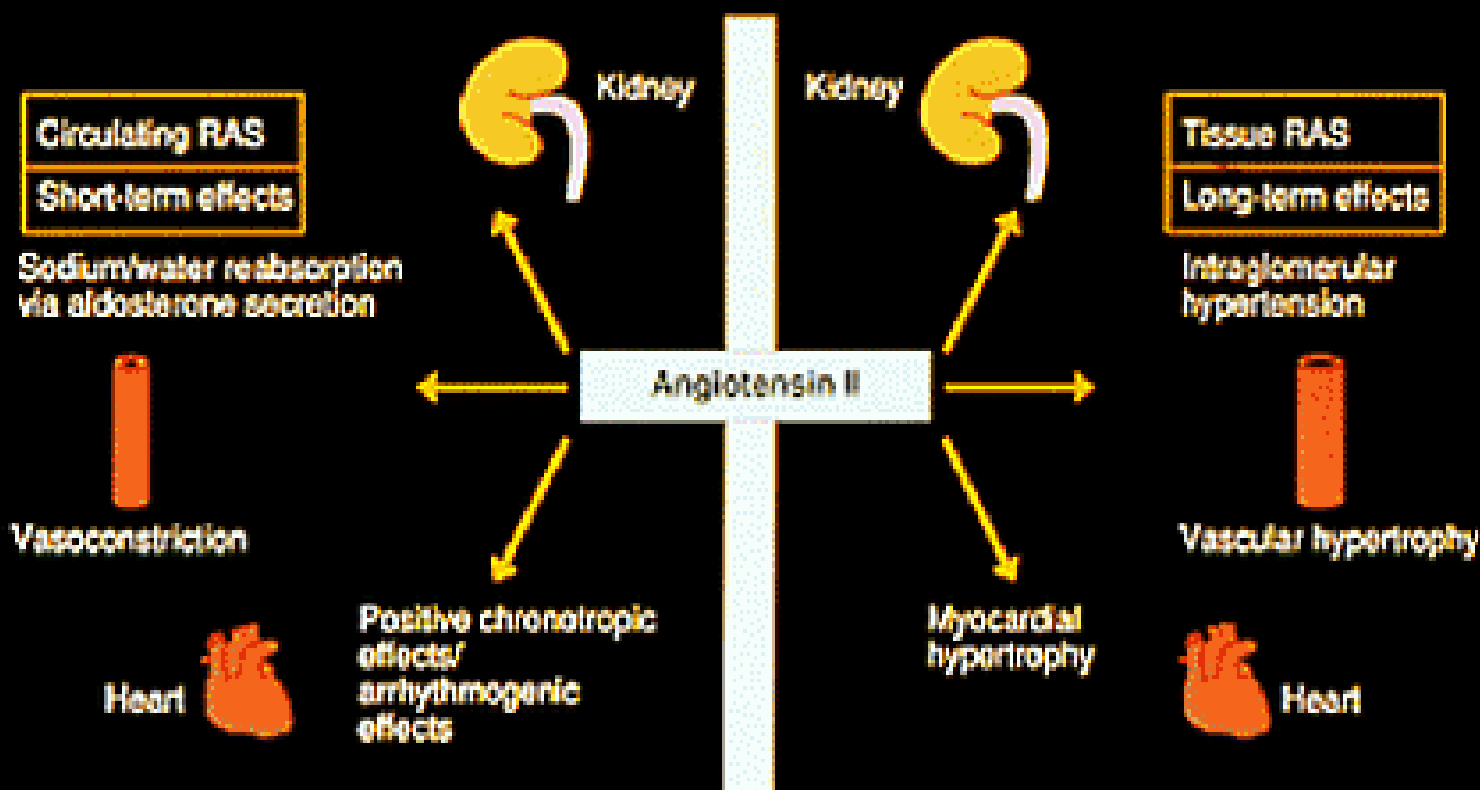
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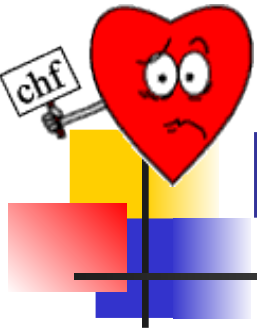
- Neurohumoral Adaptations
  - “double-edged swords”
  - Renin-Angiotensin-Aldosterone System
  - Sympathetic Nervous System
  - Antidiuretic Hormone
  - Atrial and Brain Natriuretic Peptides
  - Endothelin





# Circulating and tissue RAS influence cardiovascular system



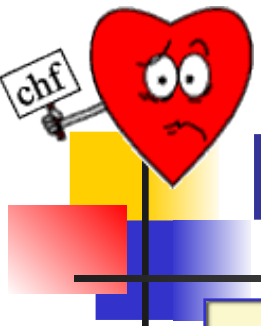


# Help initially

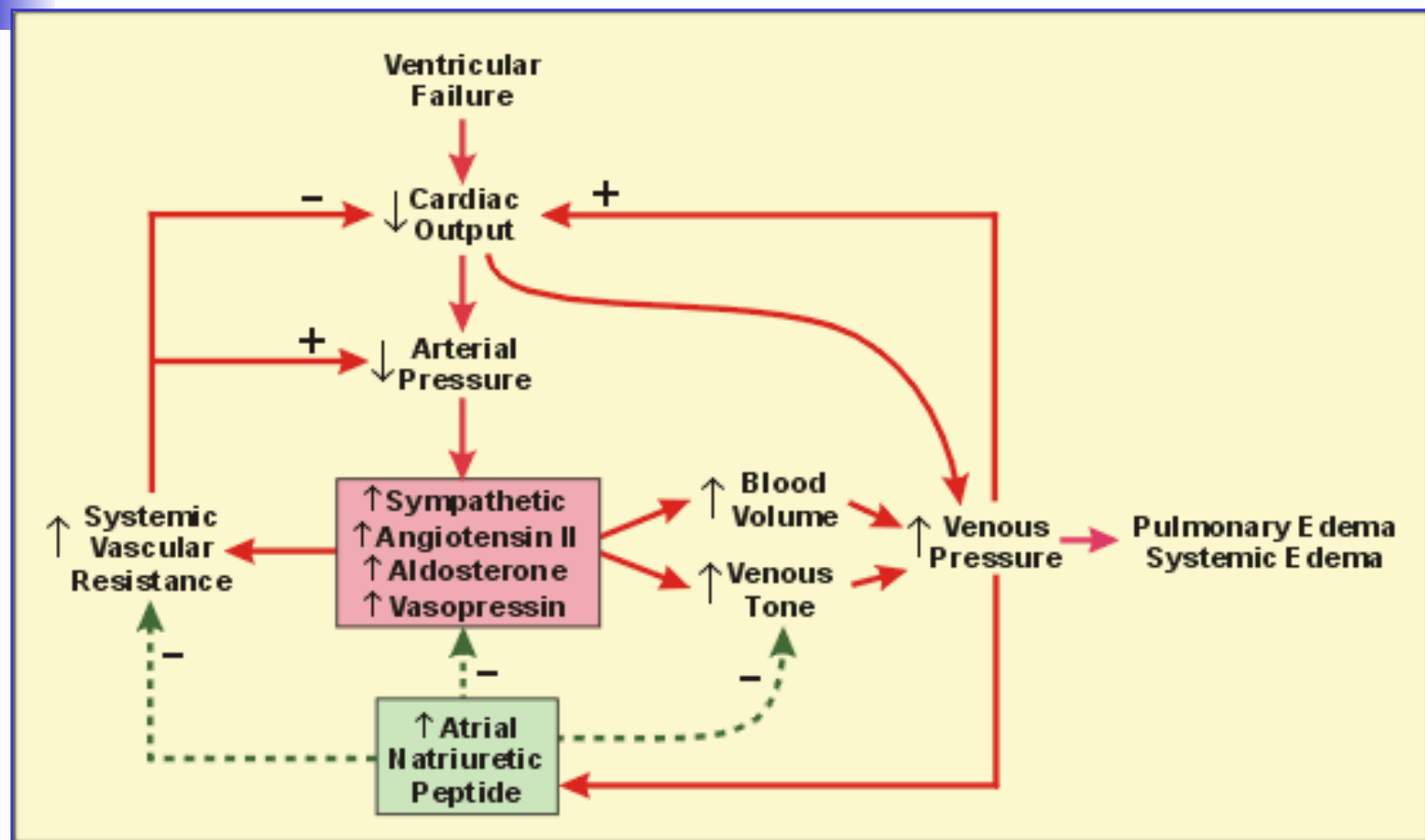
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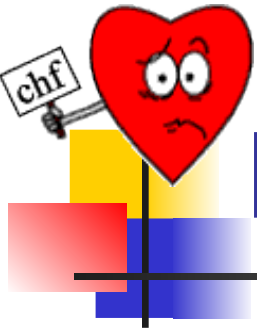
- Vasoconstriction
  - Redistributes blood to vital organs
- Restoration of Cardiac Output
  - Increased myocardial contractility and heart rate
  - Expansion of the extracellular fluid volume





# Hurt long-term

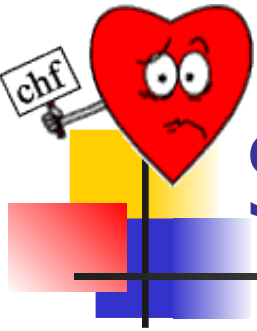




# Precipitating Causes

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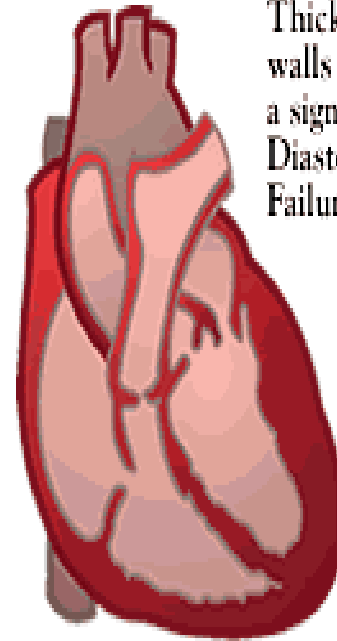
- **Common**
  - CAD (70%)
  - Systemic Hypertension
  - Idiopathic
- **Less Common**
  - Diabetes Mellitus
  - Valvular Disease
- **Rare**
  - Anemia
  - Connective Tissue Disease
  - Viral Myocarditis
  - Hemochromatosis
  - HIV
  - Hyper/Hypothyroidism
  - Hypertrophic Cardiomyopathy
  - Infiltrative Disease including amyloidosis and sarcoidosis
  - Mediastinal radiation
  - Peripartum cardiomyopathy
  - Restrictive pericardial disease
  - Tachyarrhythmias
  - Toxins
  - Trypanosomiasis (Chagas' disease)



# Systolic vs. Diastolic

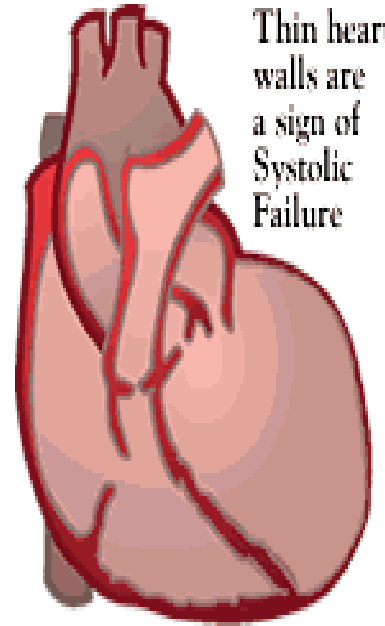
- Diastolic dysfunction
  - EF normal or increased
  - Hypertension
- Systolic dysfunction
  - $EF < 40\%$
  - Usually from coronary disease

## Diastolic Failure

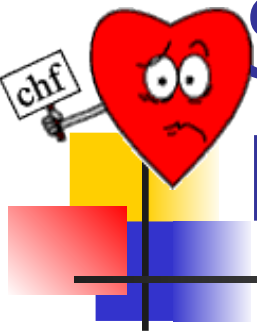


Thick heart walls are a sign of Diastolic Failure

## Systolic Failure



Thin heart walls are a sign of Systolic Failure



# Subtypes of Systolic Heart Failure

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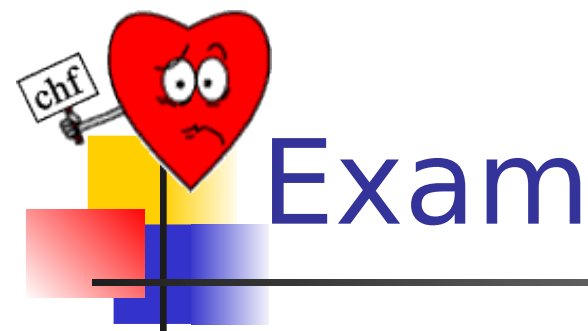
- High output
  - Severe anemia
  - AV malformations
  - hyperthyroidism
- Low cardiac output
- Right Heart Failure
  - Peripheral edema
- Left Heart Failure
  - Pulmonary congestion
- Biventricular Failure
  - Systemic and pulmonary congestion



# Confirming the presence of CHF – History and Physical Exam

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- MI
- Dependent Edema
- Positive hepatojugular reflex
- Displacement of the cardiac apical pulsation
- Gallop rhythm



- Major Criteria

- Paroxysmal nocturnal dyspnea
- Neck Vein Distention
- Rales
- Cardiomegaly
- Pulmonary Edema
- S3 Gallop
- Hepatojugular Reflex

- Minor Criteria

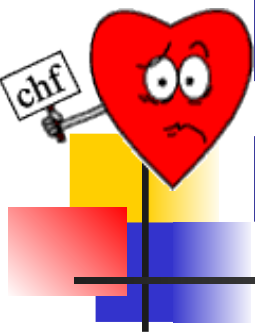
- Ankle edema
- Nocturnal Cough
- Dyspnea on ordinary exertion
- Hepatomegaly
- Pleural Effusion
- Tachycardia >120bpm



# Confirming the Presence of Heart Failure

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- CXR-cardiomegaly and pulmonary edema; Kerley's B Lines
- Laboratory Values
- BNP
- Electrocardiogram/ECHO
  - Anterior Q waves, LBBB, LVH

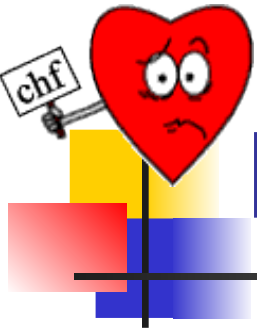


# Negative Prognostic Factors

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- Clinical
  - Increased Age, Diabetes, Smoking
- Laboratory
  - Hyponatremia, Elevated neurohormones
- Hemodynamic
  - Reduced EF, Increased Pulm Cap Wedge Pressure
- Electrophysiological
  - A-fib, A-flutter, Ventricular ectopy, V-tach

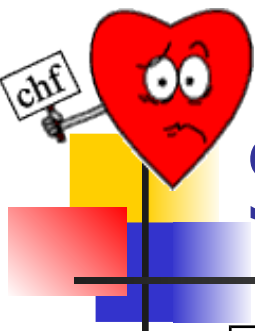




# NYHA Classification

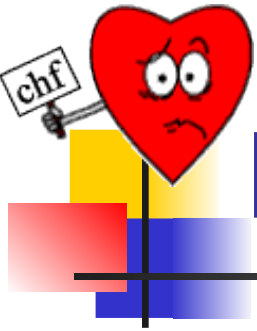
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- Class I
  - Symptoms with greater than ordinary activity
- Class II
  - Symptoms with ordinary physical activity
- Class III
  - Symptoms with minimal physical activity
- Class IV
  - Symptoms at rest



# Six-Minute Walk Test

<b>Distance Walked (m)</b>	<b>Hospitalization Rate in 1 year (%)</b>	<b>Mortality rate in 1 year (%)</b>
300	40.9	10.2
301-374	33.6	7.9
375-449	27.4	4.2
>450	19.9	3.0



# Principles of Treatment

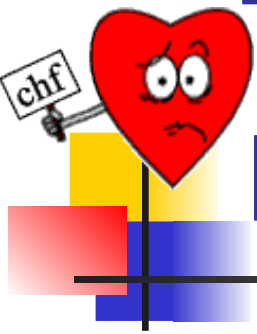
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## Systolic HF

- ↓ Preload
- ↓ Afterload
- ↑ *Inotropy*
- ↓ Neurohumoral activity

## Diastolic HF

- ↓ Preload
- ↓ Afterload
- ↑ *Filling time*
- ? Neurohumoral activity



# Treatment of Systolic Heart Failure

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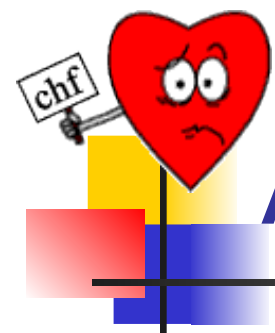
- ACE Inhibitors
  - Decrease the rate of mortality in all patient with systolic heart failure
  - Causes balanced vasodilation and prevents myocardial hypertrophy and fibrosis



# Angiotensin-Receptor Blockers

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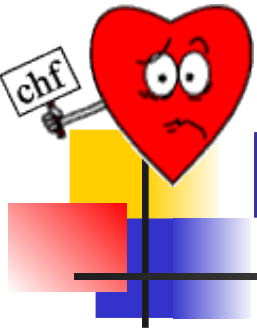
- Comparable to ACE inhibitors
- Reduce all-cause mortality
- More expensive than ACE inhibitors but no cough



# ACE + ARB

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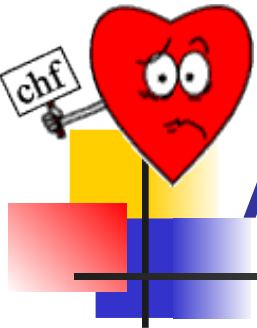
- CHARM-Added (Lancet 2003)
  - 2548 NYHA II-IV; LVEF < 40%
  - CV death, hospital admission
  - NNT=25



# Beta-Blockers

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- Use in stable, chronic disease
- Titrate slowly
- Decrease Cardiac Sympathetic Activity
- Contraindications-bradycardia, heart block or hemodynamic instability
- Carvedilol vs. Metoprolol (COMET 2003)
  - 3029 pts; carvedilol 25mg bid vs. metoprolol 50 mg bid

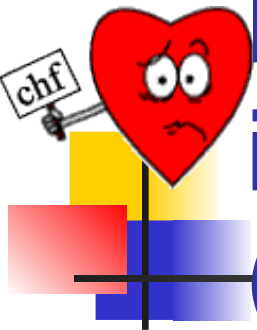


# Aldosterone Antagonists

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- Spironolactone (Aldactone; RALES 1999)
  - Class III/IV, ACE, Lasix, EF < 35%
  - NNT=10
  - Hyperkalemia, gynecomastia
- Eplerenone (Inspra; EPHESUS 2003)
  - NNT=43
  - More pts on beta-blockers





# Hydralazine (Apresoline) and isosorbide dinitrate (Sorbitrate)

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Hydralazine

Reduces systemic vascular resistance  
by preferentially dilating arterioles

Isosorbide Dinitrate

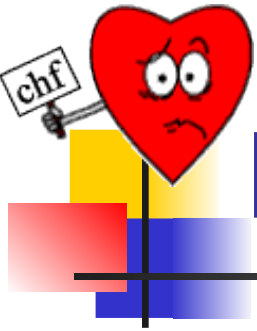
Preferential Venodilator-reduces  
ventricular filling pressure and treat  
pulmonary congestion

Reduces mortality

Poor tolerability



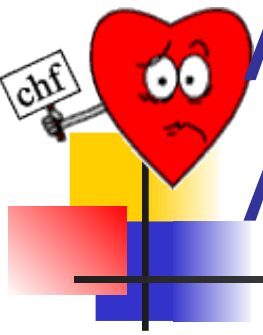
- May relieve symptoms, does not reduce mortality
- More admission for suspected digoxin toxicity



# Diuretics

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- Mainstay of symptomatic treatment
  - Improve fluid retention
  - Increase exercise tolerance
  - No effects on morbidity or mortality



# Antiplatelet Therapy and Anticoagulation

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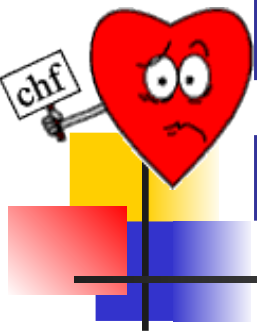
- Increased risk of Thromboembolic events, 1.6-3.2% per year
- Antiplatelet therapy (aspirin) is not useful in patient in sinus rhythm
- Coumadin for patient with atrial fibrillation or a previous thromboembolic event



# Nonpharmacological Management

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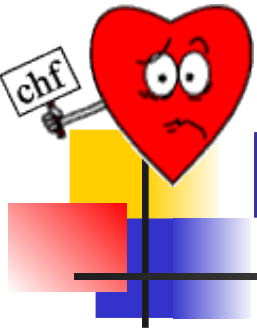
- Sodium Restriction to 2g/day
- Risk Factor Management
- Exercise
  - Decreases mortality (NNT=4)
  - Decreases hospitalizations (NNT=5)
- Multidisciplinary, Disease-Management Approach



# Principles of Treatment- Diastolic Dysfunction

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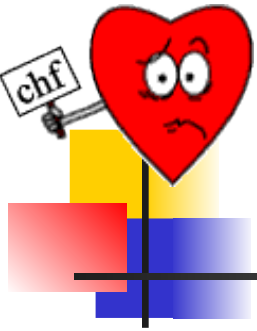
- ↓ ■ Preload
- ↓ ■ *Afterload*
- ↓ ■ *Chronotropy*
- ↓ ■ Neurohormonal  
Activity



# Diastolic Dysfunction

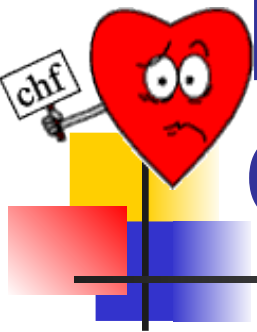
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- Acute Management is the SAME
- Chronic Management is CONTROVERSIAL
  - Diuretics-dec fluid volume
  - CCB-promote left ventricular relaxation
  - ACE-I-promote regression of left ventricular hypertrophy
  - Beta-blockers/antiarrhythmic agents-control heart rate or maintain atrial contraction



- QUESTIONS?

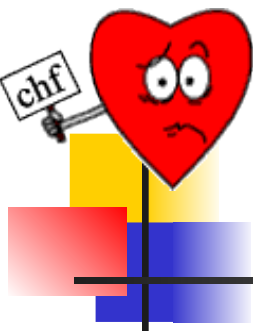




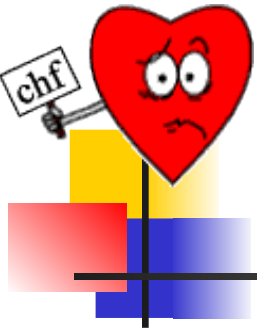
# Recent Inservice Exam Questions

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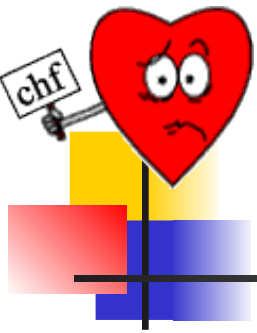
- 1. Which one of the following is considered a contraindication to the use of beta-blockers for congestive heart failure?
  - A) Mild Asthma
  - B) Symptomatic Heart Block
  - C) New York Heart Association (NYHA) Class III heart failure
  - D) NYHA Class I heart failure in a patient with a history of a previous myocardial infarction
  - E) An ejection fraction  $<30\%$



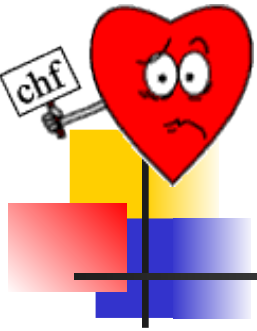
- 1. Answer B
- According to several randomized, controlled trial, mortality rates are improved in patient with heart failure who receive beta blockers in addition to diuretics, ACE inhibitors, and occasionally, digoxin. Contraindications to beta blocker use include hemodynamic instability, heart block, bradycardia, and severe asthma. Beta-blockers may be tried in patients with mild asthma or COPD as long as them are monitored for potential exacerbations. B-blocker use has been shown to be effective in patient with NYHA Class II or III heart failure. There is no absolute threshold ejection fraction . B-blockers have also been shown to decrease mortality in patients with a previous history of myocardial infarction, regardless of their NYHA classification



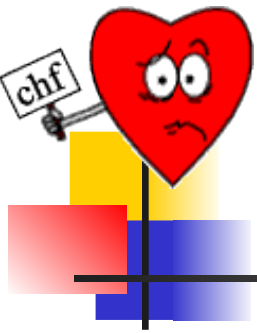
- 2. Which one of the following serologic tests would be the most helpful for detecting left ventricular dysfunction?
  - A) brain-natriuretic peptide (BNP)
  - B) Troponin-T
  - C) C-reactive protein (CRP)
  - D) D dimer
  - E) Cardiac interleukin-2



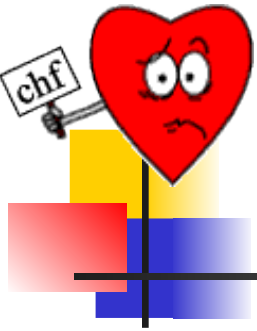
- 2. Answer A.
- BNP is a 32-amino acid polypeptide secreted from the cardiac ventricles in response to ventricular volume expansion and pressure overload. The major source of BNP is the cardiac ventricles, and because of its minimal presence in storage granules, its release is directly proportional to ventricular dysfunction. It is a simple and rapid test that reliably predicts the presence or absence of heart failure.



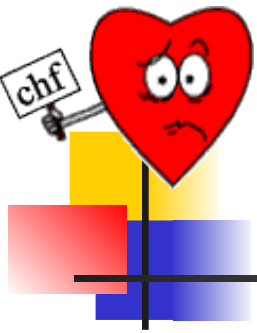
- 3. Which one of the following is a risk factor for perioperative arrhythmias?
  - A) Supraventricular Tachycardia
  - B) Congestive Heart Failure
  - C) Age >60
  - D) Premature Atrial Contractions
  - E) Past history of hyperthyroidism



- 3. Answer B
- Significant predictors of intraoperative and perioperative ventricular arrhythmias include preoperative ventricular (not supraventricular) ectopy, CHF, and tobacco use. Age and history of hyperthyroidism are not significant predictors of perioperative ventricular arrhythmias.



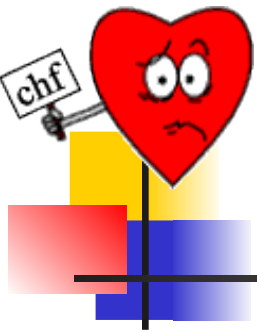
- 4. Which one of the following is preferred for chronic treatment of congestive heart failure due to left ventricular systolic dysfunction?
  - A) Diuretics
  - B) Digoxin
  - C) Calcium Channel Blockers
  - D) ACE inhibitors
  - E) Hydralazine (Apresoline) plus isosorbide dinitrate (Isordil, Sorbitrate)



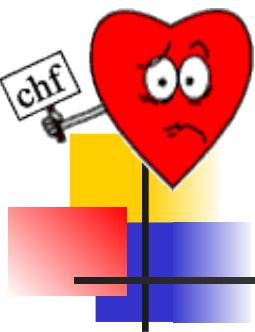
#### ■ 4. Answer D

- ACE-I are the preferred drugs for CHF due to LV systolic dysfunction, because they are associated with the lowest mortality. The combination of hydralazine/isosorbide dinitrate is a reasonable alternative, and diuretics should be used cautiously. It is not known whether Digoxin affects mortality, although it can help with symptoms.

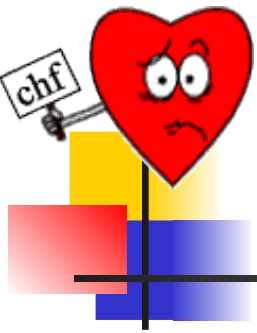




- 5. A 72-year-old male with class III CHF due to systolic dysfunction asks if he can take ibuprofen for his “aches and pains.”



- A) NSAIDs are a good choice for pain relief, as they decrease systemic vascular resistance
- B) NSAIDs are a good choice for pain relief, as they augment the effect of his diuretic
- C) High-dose aspirin (325mg/day) is preferable to other NSAIDs for patients taking ACE-I
- D) NSAIDs, including high-dose aspirin, should be avoided in CHF patient because they can cause fluid retention



- 5. Answer D
  - If possible, NSAIDs should be avoided in patients with heart failure. They cause sodium and water retention, as well as an increase in systemic vascular resistance which may lead to cardiac decompensation. NSAIDs may negate or decrease entirely the beneficial unloading effects of ACE inhibition.